III SSAGI
CHILE 2001

III SOUTH AMERICAN SYMPOSIUM ON ISOTOPE GEOLOGY

Pucón, Chile
21-24 de Octubre de 2001
October 21-24, 2001

EXTENDED ABSTRACTS VOLUME

Organized by : Servicio Nacional de Geología y Minería de Chile and
Departamento de Geología de la Universidad de Chile,
with the sponsorship of the Sociedad Geológica de Chile

CONTENTS OF DISK

THE ITAIACOCA GROUP: U-PB(ZIRCON) RECORDS OF A NEOPROTEROZOIC BASIN

Siga Jr. O[1].; Basei, M.A.S[1].; Weber, W[1].; Sato, K[1].; Reis Neto, J.M[2].; Prazeres Filho, H. J[1].; Nutman, A. P[3].

[1]Instituto de Geociências, Universidade de São Paulo, Rua do Lago 562-Cid.Universitária, São Paulo-SP. Cep 05508-900, Brazil (E-mail: osigajr@usp.br)
[2]Setor de Ciências da Terra, Departamento de Geologia, Universidade Federal do Paraná, CP 19011, Cep 81531-990, Curitiba-PR, Brazil.
[3]Reserach School of Earth Science - Australian National University, Camberra

Keywords: U-Pb zircon, Metavulcano sequence, Tectonic evolution,

1. INTRODUCTION

The Itaiacoca Group is a metavolcanoclastic sequence occupring a narrow, NE-SW oriented belt between the Cunhaporanga (NW) and Três Córregos (SE) granitic batholiths in eastern Paraná State, Southeast Brazil. Here we discuss the age pattern revealed by SHRIMP and conventional U-Pb dating of zircon from metavolcanic rocks of this Group. We use current views on tectonic positioning, lithostratigraphic characteristics and previously obtained ages to discuss the possible geological scenarios which were associated with the deposition and subsequent evolution of the belt (fig. 1).

The interpretation of the tectonic position of Precambrian basins – continental rift back arc, fore arc, intra-arc, interarc - is often not an easy task since all the necessary variables for the definition are not always evident. Furthermore, it is usually necessary to allow for the profound transformations effected by the superposed processes involved during the evolution from the original depositional environment through subduction and collision processes with accompanying deformation, development of shear zone systems, and intrusion by granitic plutons. Finally, some of the essential geological records may be missing.

2. GEOLOGICAL FEATURES

The geological information used here was obtained during geological mapping of the southern part of the Itaiacoca belt between Abapã and Socavão, PR undertaken by members of the IGc-USP during 1997 (Prazeres Filho et al. 1998). In this area, three main units are recognized, from base to top: metawackes with an important volcanic contribution; metacarbonate and metapelitic rocks; and metapsammitic rocks. This succession is similar to that described by Souza (1990) and Reis Neto (1994). Regional metamorphism is in the chlorite to biotite zones of the greenschist facies.

In the basal unit, metamorphosed feldspathic sandstones predominate, and contain interbeddings of metavolcanic and metavolcanoclastic rocks. Graded and cross bedding is preserved in the metasandstones, which are immature, rich in quartz and predominately microcline alkali feldspar clasts, suggesting that the source area was granitic. The clasts are set in a fine-grained matrix composed of clay minerals, sericite and chlorite. The metavolcanic rocks form flows of variable thickness interbedded with metapsammites. Thin levels of pale green phyllites (volcanic ash beds?), and other metapyroclastic rocks are also observed. The flows are usually highly vesicular or rich in amygdales, both volcanic features being stretched. The rocks often contain large amounts of sanidine, opaque masses and devitrified material. We identify these rocks as trachytes, which are very rich in K_2O (6-12%) and other LILE according to Reis Neto (1994).

Dolomitic marbles interbedded with impure marbles (calcic phyllites and carbonate-bearing phyllites) predominate in the middle unit. Structures such as wavy and lenticular bedding are preserved, as are climbing bedding, cross-bedding, pisoliths and oolites. Banks of columnar stromatolites are present associated with algal mats . The marble host levels of pale green chlorite-sericite phyllites, which may be former volcanic ashes, and metabasic rocks with compositions of tholeiitic basalts of

extensional environments (Reis Neto, 1994). In the proximity of the Cunhaporanga batholith, these rocks are transformed into contact metamorphic assemblages rich in talc and tremolite.

The upper unit is not very thick, and is formed by orthoquartzites and fine- to medium-grained sandstones, interbedded with sericite phyllites, graphite phyllites, psammitic-pelitic metarhythmites, metasiltites and meta-argillites. Horizontal lamination, normal micro gradational bedding and low-angle cross lamination are preserved structures.

An S1 foliation is almost parallel to the bedding So, and is defined by orientation of sericite, chlorite and, more rarely, biotite. S1 is affected by heterogeneous crenulation. This structural pattern is different from that seen in the Açungui basin, where deformation is controlled by low- and high-angle shear zones, and transport is southwards;

3. GEOCHRONOLOGICAL STUDIES.

Available geochronological data based on Pb-Pb, Rb-Sr and Sm-Nd measurements in marbles and metavolcanic rocks suggest that the age of sedimentation of the group is Mesoproterozoic, between 1250 and 1080 Ma (Reis Neto, 1994).

U-Pb analyses of zircon grains from metavolcanic rocks interbedded with metawackes collected at points AB-1 and Hot-2 yield ages significantly different from the Mesoproterozoic age preferred by Reis Neto (1994). Zircon grains from AB-1 were analysed by SHRIMP after examination using cathodoluminescence and back-scattered electron images. Weakly tinted, euhedral, long prismatic crystals predominate. They present homogeneously distributed internal growth zones, and oscillatory zones of cloudy aspect at the borders. Analyses of points in the homogeneous growth zone, and in the center of the border zone yielded an age of 628±18 Ma (MSWD=1) using the Tera-Wasserburg diagram. This age is believed to represent the age of crystallization of the volcanic rocks. Points analysed in the oscillatory border zones of grains of irregular and short prismatic shapes yielded ages of 2480 Ma and 1990 Ma. These ages are thought to represent the ages of the source rocks (fig. 2).

Zircon grains from point Hot-2 are colourless long prisms, rich in inclusions. The analytical points for three magnetic fractions fall close to the concordia, and define an upper intercept (crystallization) age of 636± 30Ma, similar to that obtained for the other point (fig. 3).

Although these Neoproterozoic ages must be considered ad preliminary, nevertheless they probably represent an age close to that of the volcanism and sedimentation of the Itaiacoca basin.

4. FINAL CONSIDERATIONS

Some aspects of the Itaiacoca basin and its evolution merit emphasis:

- The rocks are pinched between the Cunhaporanga (NW) and Três Córregos (SE) batholiths, which are thought to represent Neoproterozoic (630-590 Ma) magmatic arcs (Prazeres Filho, 2000);
- The Três Córregos batholith is slightly older than the Cunhaporanga batholith, which caused contact metamorphism of the rocks of the Itaiacoca Group;
- The basal unit of the Group contain an important alkaline volcanic component, interbedded with psammites with quartz and K-feldspar clasts suggestive of a granitic source region;
- The U-Pb zircon ages indicate a Neoproterozoic deposition age at about 630Ma;
- Unpublished K-Ar analyses of neoformed fine-grained (<2μm) sericites from phyllites and metavolcanic rocks showed that the metamorphism ocurred between 628 and 610 Ma.

The Itaiacoca basin therefore developed at about the same time as the intrusion of the Três Córregos batholith, and shortly before the intrusion of the Cunhaporanga batholith. Regional metamorphism of the sequence occurred some 10-15 Ma after deposition, which suggests that the closure of the basin must have been rapid. Such a scenario may be the result of initial basin formation in a back-arc, followed by evolution including granite intrusion during collision through and intra-arc environment, ending up as an interarc basin.

Acknowledgements: The authors acknowledge the support from FAPESP (contract no. 99/04040-8) which permitted this study to be undertaken and to Prof. Dr. Ian McReath for suggestion and critical review of the manuscript.

REFERENCES

Basei, M.A.S.; Siga Jr., O.; Machiavelli, A.;Mancini, F. 1992. Evolução tectônica dos

terrenos entre os Cinturões Ribeira e Dom Feliciano (PR-SC). Rev. Bras. Geoci., 22(2):216-221.

Reis Neto , J.M. – 1994 – Faixa Itaiacoca :Registro de uma Colisão entre dois Blocos Continentais no Neoproterozóico. Tese de Doutoramento , IG- USP , 253p.

Souza , A .P. – 1990 – Mapa Geológico na Escala 1:50000 e Esboço da Evolução Tectônica e Sedimentar do Grupo Itaiacoca nas Folhas Barra do Chapéu e Ouro Verde – SP/PR. Dissertação de Mestrado – IG –USP, 200p.

Prazeres Filho, H.; Guimarães, G.; Basei ,M.A.S.; Siga Jr , O.; Reis Neto , J.M.; Campanha , G.; Sallun Filho, W. – 1998 – Mapa Geológico 1:50000 da Porção Centro – Sul da Faixa Itaiacoca – PR . XL Congr. Bras. Geol. Belo Horizonte , MG – Resumos , V.1 , p.36 .

Prazeres Filho , H. – 2000 – Litogeoquímica, Geocronologia (U-Pb) e Geologia Isotópica dos Complexos Graníticos Cunhaporanga e Três Córregos, Estado do Paraná. Msc Dissertation, São Paulo. IG-USP, 180p.

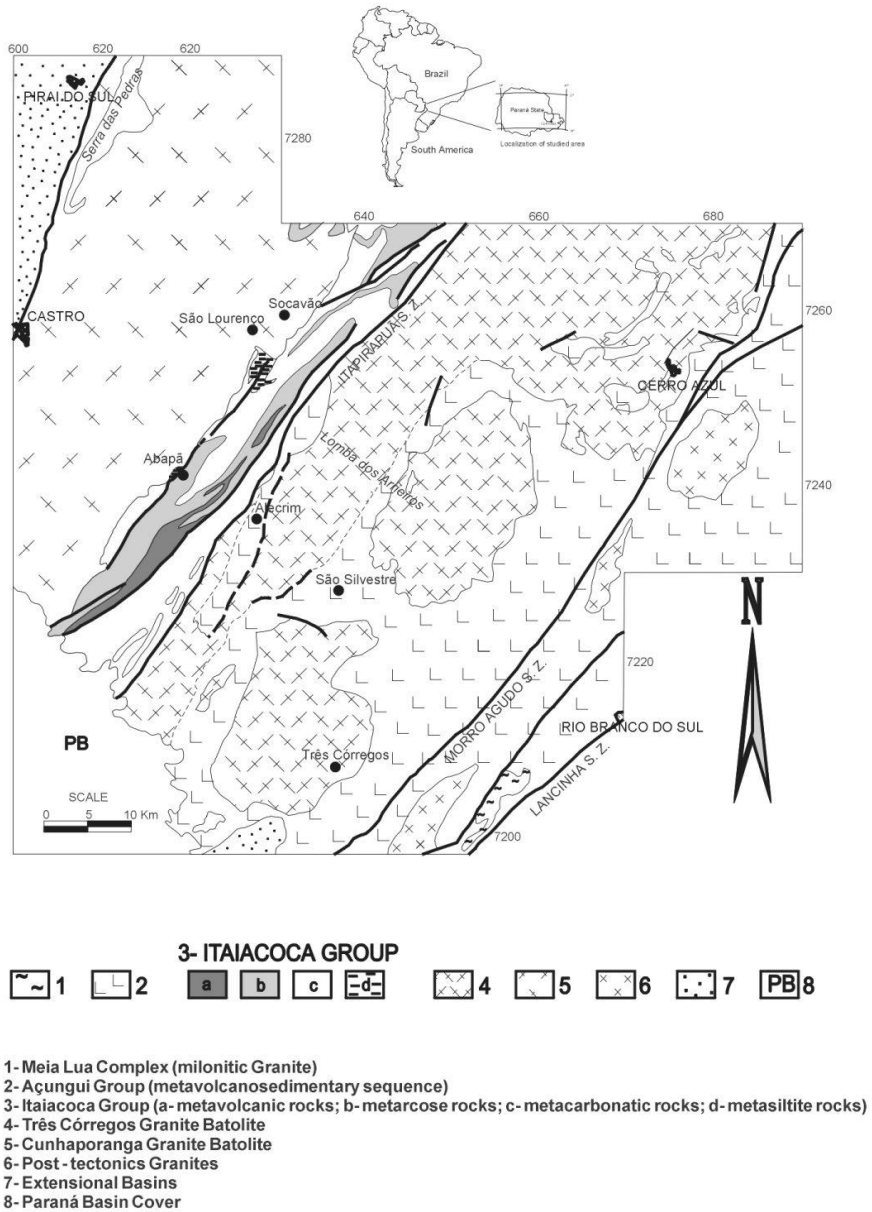

Figure 1- The Southern part of Ribeira Belt, Paraná State, Brazil.

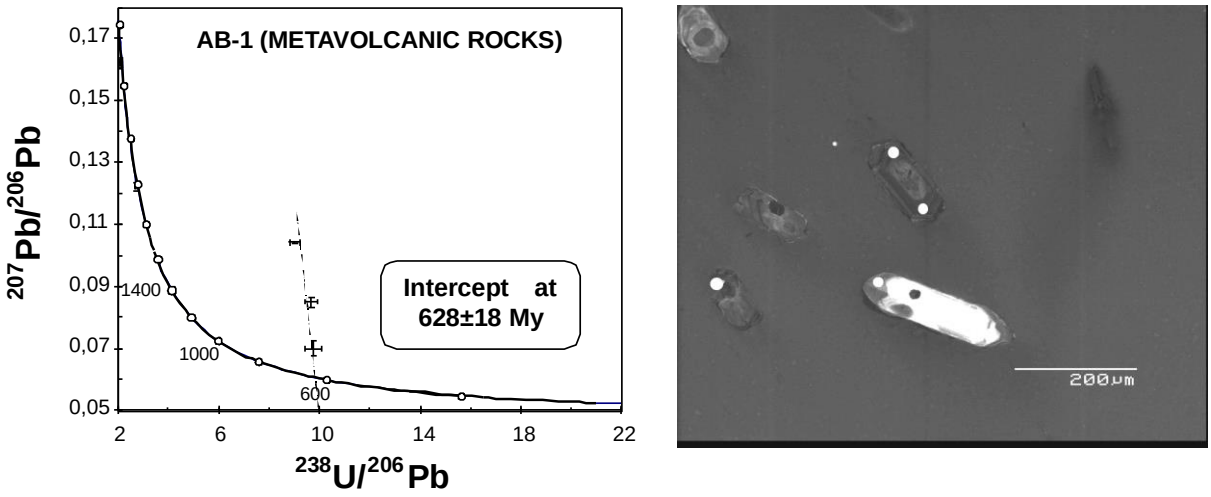

Figure 2- SHRIMP U-Pb zircon analysis from metavolcanic rock (AB-1).

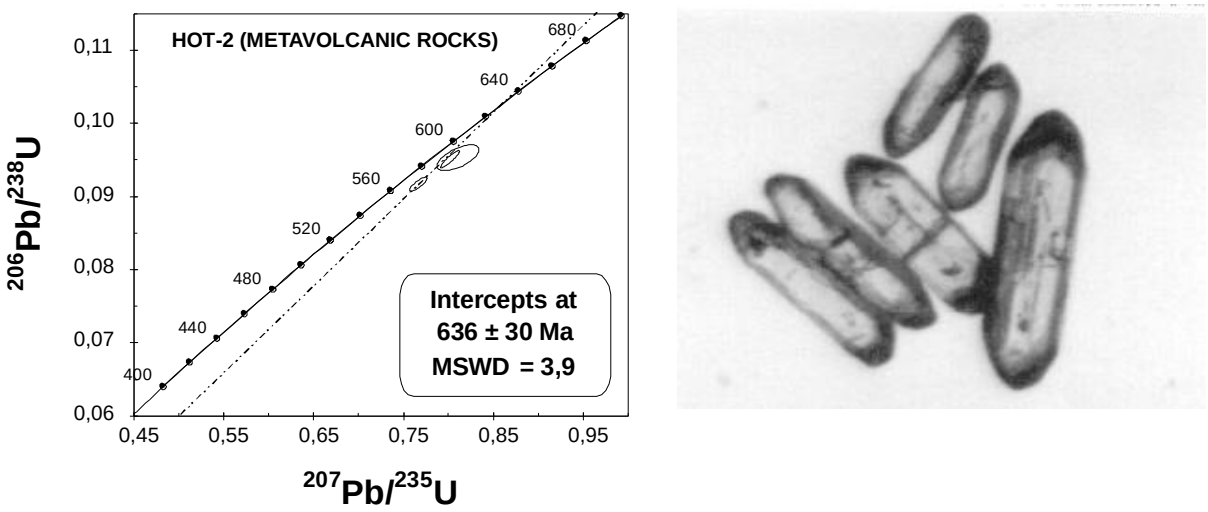

Figure 3- Conventional U-Pb zircon analysis from metavolcanic rock (HOT-2).